



City of Santa Barbara

Storm Water BMP Guidance Manual

Training for City Staff

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City of Santa Barbara Creeks Division • June 25, 2009

Manual Chapters

- Chapter 1: Introduction
  - Manual Purpose
  - NPDES Phase II SWMP Requirements
  - Project Tiers & Design Review Process
  - How to Use the Manual
- Chapter 2: Site Assessment and BMP Selection
- Chapter 3: Site Soil and Infiltration Assessment
- Chapter 4: Site Design BMP Options

Manual Chapters

- Chapter 5: Basic BMP Options
- Chapter 6: Storm Water Runoff BMP Options
  - BMP Sizing Requirements
  - Design Specifications
  - Operations and Maintenance Requirements
- Appendices

Manual Purpose

- Reduce surface water pollution from urban storm water runoff and address existing water quality challenges
  - Urban runoff is the **#1 contributor** to surface water pollution in Santa Barbara
  - Over 15 Santa Barbara water bodies were proposed to be listed as "impaired" by the regional water board last year

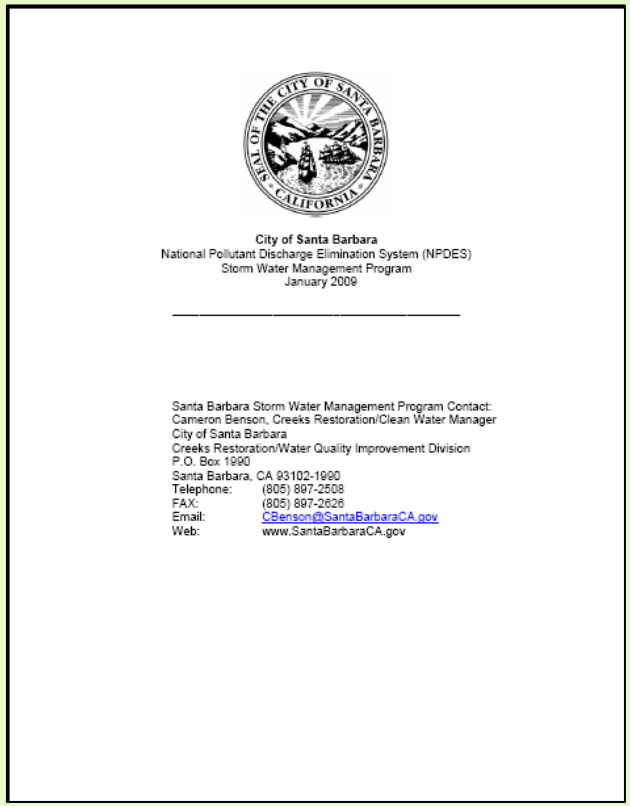
Manual Purpose (cont'd)

- Provide guidance to City staff and residents for meeting the City's Storm Water Management Program (SWMP) requirements

- Requirements apply to post-construction runoff
  - *Post-construction runoff*: storm water runoff after construction activities have been completed

SWMP Requirements

- City is required to implement a SWMP under the Federal Clean Water Act
- City's SWMP was approved in January 2009
- City currently implementing year one of the five-year SWMP requirements



City of Santa Barbara
National Pollutant Discharge Elimination System (NPDES)
Storm Water Management Program
January 2009

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SWMP Requirements

- SWMP must include 6 sections:
  - Public Education
  - Public Participation
  - Illicit Discharge Detection and Elimination
  - Construction Site Storm Water Runoff Control
  - **Post-Construction Runoff Control BMPs**
  - Pollution Prevention/Good Housekeeping
- Post-construction runoff control requirements vary by project type

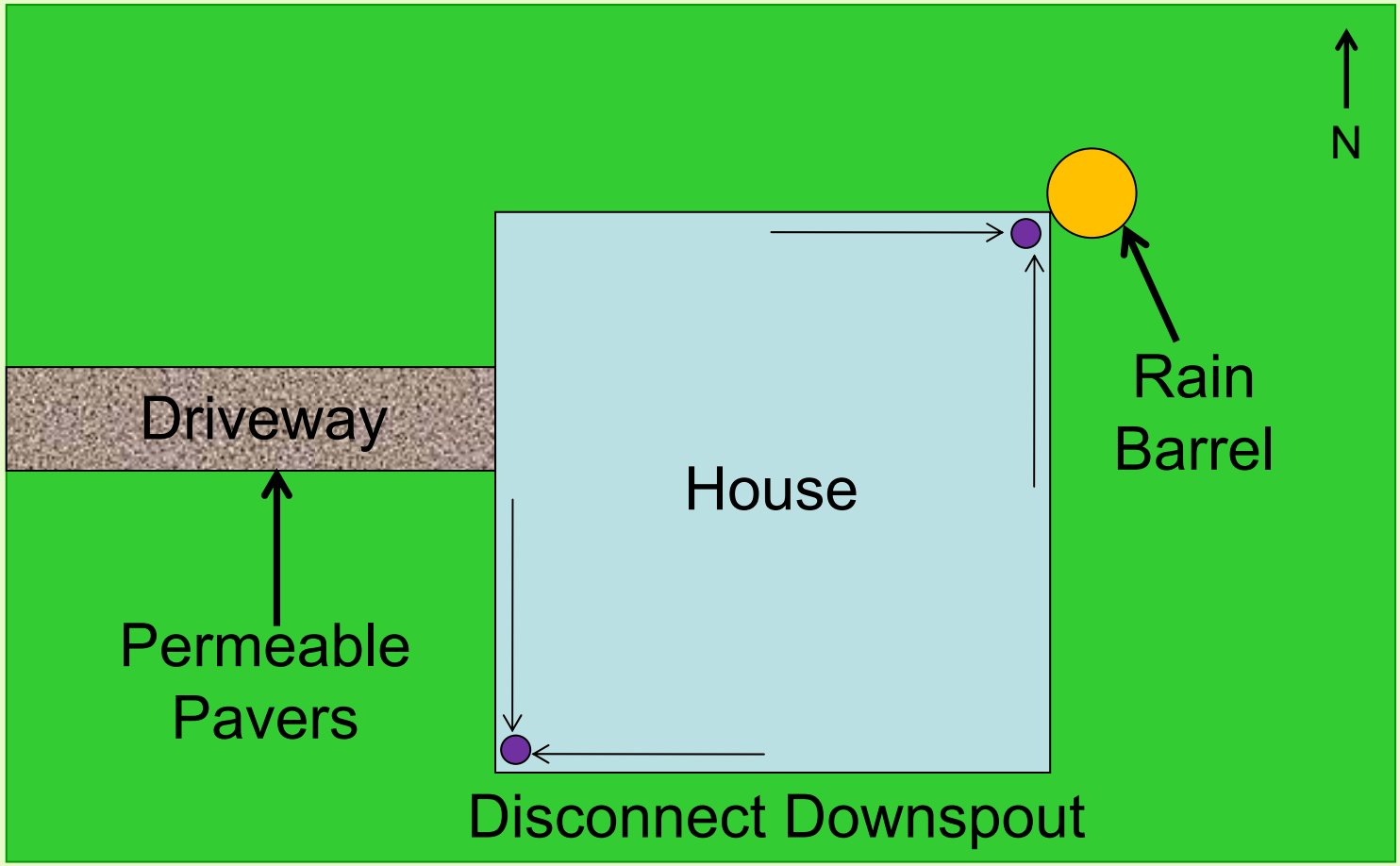
Project Tiers & How to Use the Manual

- Tier 1 – Small Projects
  - Projects with < 500 sq. ft. of new or replaced impervious area
- Tier 2 – Medium Projects
  - Residential projects with 500 to 4000 sq. ft. of new or replaced impervious area
- Tier 3 – Large Projects
  - Residential with > 4000 sq. ft. of new or replaced impervious area, commercial, mixed use, parking lots w/ ≥ 10 spaces, hillside residential, and public works projects

Project Design Review Process

- **Tier 1**
  - Voluntary implementation of any BMP types
- **Tier 2**
  - Include in simple site plan:
    - One or More Basic BMPs (Chapter 5) – *Required*
    - Site Design and Storm Water Runoff BMPs (Chapters 4 and 6) – *Voluntary*

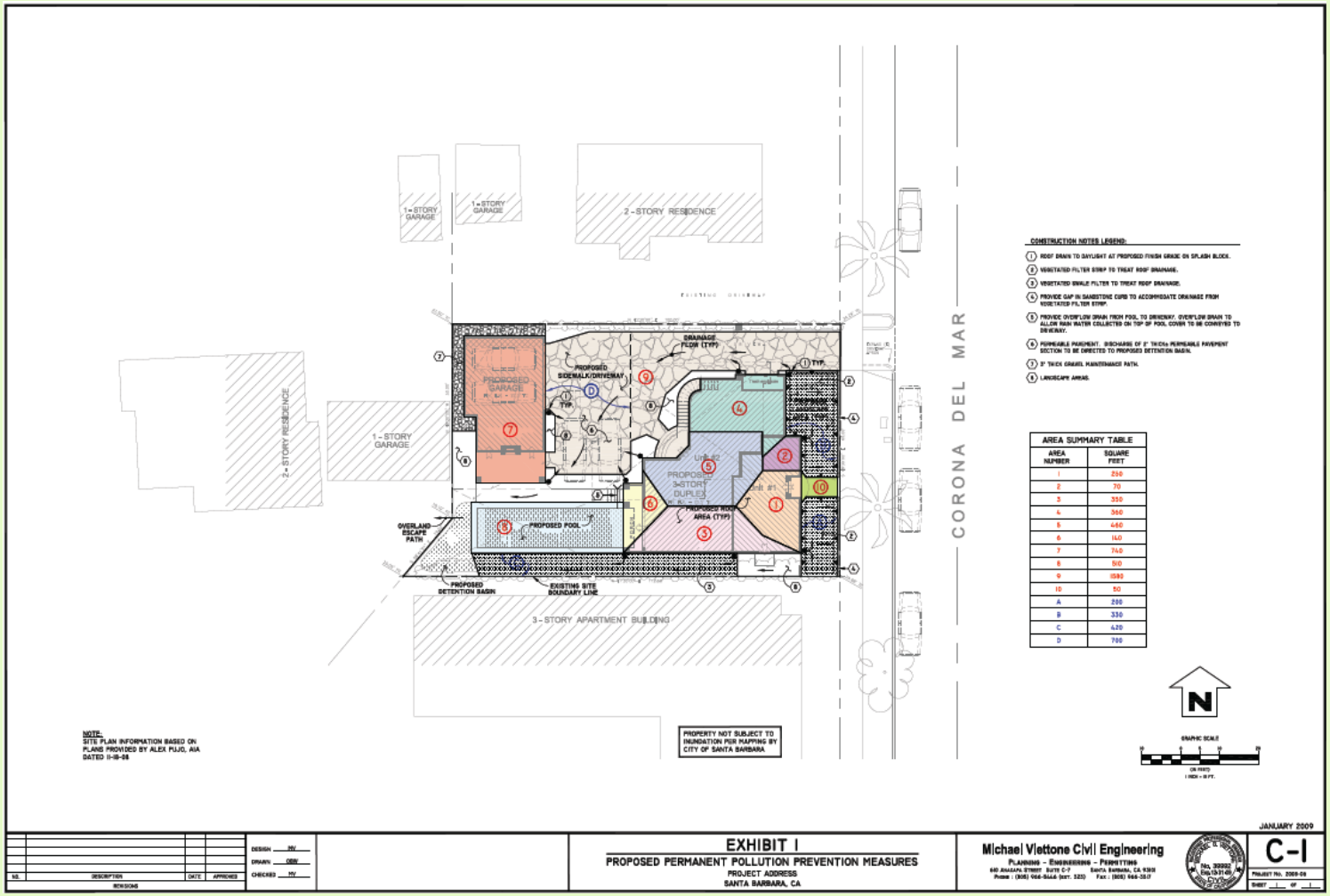
Tier 2 – Simple Site Plan



Project Design Review Process

- **Tier 3**
  - SWMP Sizing Requirements Apply
  - DART SWMP Checklist
    - Responsible City staff identified
  - Preliminary Hydrology/Water Quality Plan Required

Tier 3 SWMP Application Example



Chapter 4: Site Design BMP Options

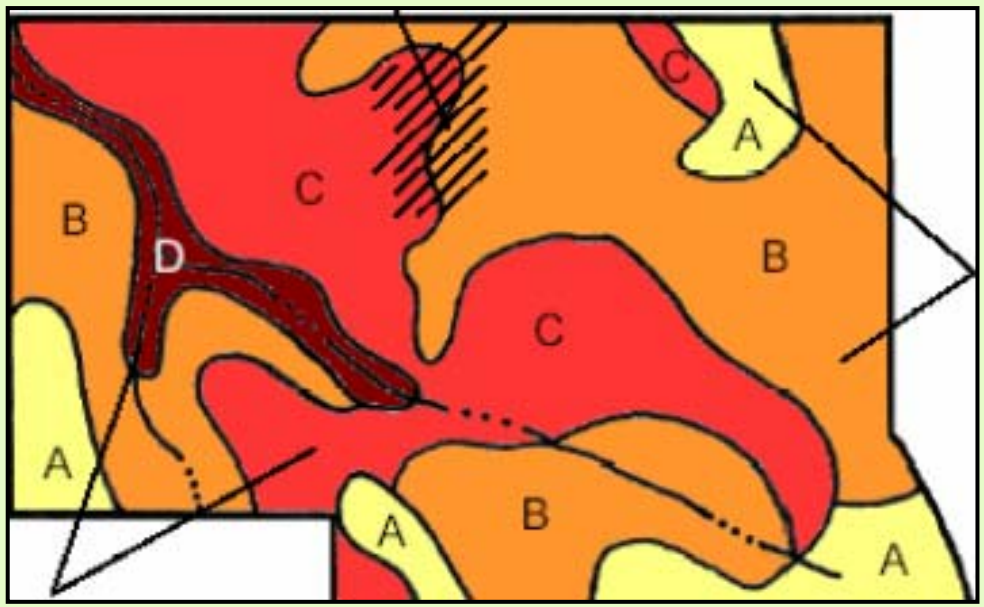
- Conserve and restore natural areas
- Maintain, restore, and utilize natural flow paths
- Site BMPs on infiltrative soils
- Minimize soil disturbance and compaction
- Minimize impervious surfaces
- Disconnect impervious surfaces and utilize pervious areas

Conserve and Restore Natural Areas

- Preserve undisturbed natural areas/riparian buffers
- Preserve natural topography
- Avoid steep slopes & floodplains
- Minimize siting on erodible soils

Site BMPs on Infiltrative Soils

- Hydrologic soil group types A and B are most suitable for BMPs that are designed for partial or full infiltration

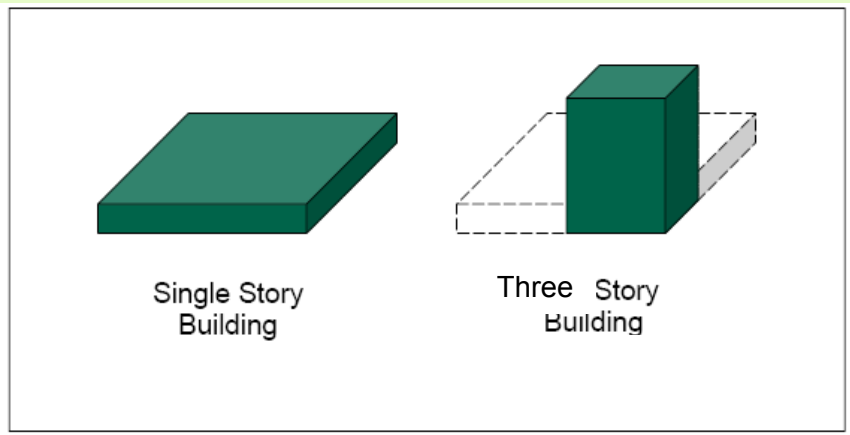


Minimize Soil Disturbance & Compaction

- Fit design to terrain
- Minimize clearing & grading to development envelope
- Save A and B soils
- Limit lot disturbance
- Use soil amendments
- Locate development in less sensitive areas
- Utilize open space

Minimize Impervious Surfaces

- Reduce road lengths and widths
- Reduce building footprint
- Reduce setbacks and frontages
- Create parking lot stormwater islands
- Reduce parking footprint
- Use alternative surfaces



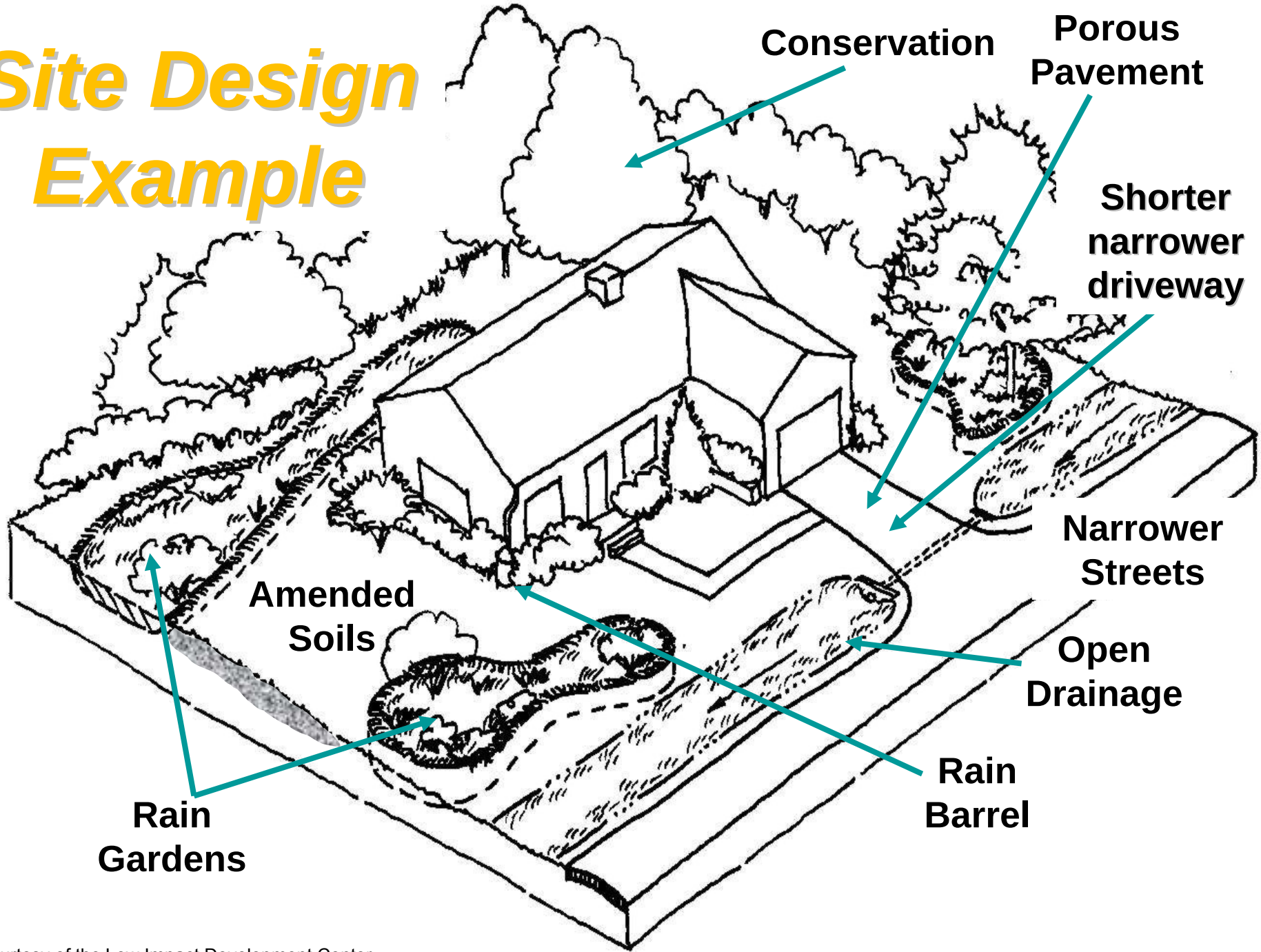
Disconnect Impervious Surfaces and Utilize Pervious Areas

Drain runoff to:

- Riparian buffers
- Pervious vegetated areas
- Natural drainage ways
- Basic and storm water runoff BMPs

Instead of storm drain systems

Site Design Example



Courtesy of the Low Impact Development Center

Chapter 5: Basic BMP Options

- Required for:
  - Tier 2
  - Tier 3 – where applicable
- No sizing requirements
- Easier to implement than storm water runoff BMPs (Chapter 6)
- Recommended simple site assessment and soil testing for Tier 2

Chapter 5: Basic BMP Options

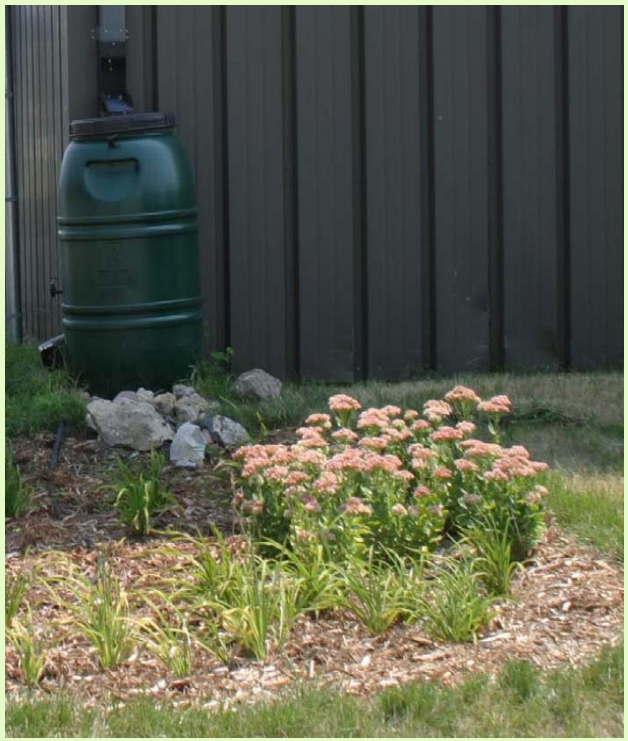
Disconnect downspouts

Flow spreading

Chapter 5: Basic BMP Options

- Rain Gardens
  - Less than 300 sq. ft. in area, or
  - Captures runoff from less than 4,000 sq. ft. of impervious area
  - If greater, size as a bioretention area (Section 6.6.1)

Chapter 5: Basic BMP Options



Rain Barrels

Contained Planters

Chapter 5: Basic BMP Options

Depression Storage

Ribbon "Hollywood" Driveways

Permeable Pavement for Single-Family Residences

Chapter 5: Basic BMP Options

Soil Amendments

Native Landscaping
(Local Plant List: Appendix G)

Chapter 6: Storm Water Runoff BMPs

- Required for Tier 3 projects
  - Except for exemptions (App. J)
- Site and soil assessment
  - Chapters 2 and 3
- Site design and basic BMPs
  - Chapters 4 and 5
- BMP selection procedure
  - Chapter 2 and Section 6.3
  - Prioritize 'above ground' BMPs first
- BMP sizing requirements
  - Section 6.2 and Appendix C

Chapter 6: Storm Water Runoff BMPs

- BMP design specifications
  - 13 BMPs included in the Manual
  - BMP design examples – Appendix D
  - Basin outlet sizing examples – Appendix E
  - Local plant list – Appendix G
- BMP operations & maintenance
  - Inspection & maintenance checklists – Appendix H
  - Example access & maintenance agreements – Appendix I
  - Example inspection & violation notifications – Appendix I

Storm Water Runoff BMP Selection Procedure

Identify Site & Soil Conditions and Primary Pollutants of Concern:

↓

Identify storm water runoff BMPs with high or very high treatment effectiveness: Table 6-1

↓

Identify which of the BMPs from Table 6-1 are suitable for the site: Table 6-2

↓

Also consider cost and long-term maintenance considerations

Chapter 3: Site Soil and Infiltration Assessment

- Preliminary site investigation
  - Soil maps provide a very general idea of soil type
  - Identify locations where development will likely have the least impact
  - Identify locations where BMPs will likely be most suitable
- Test pit investigation
  - Identify overall soil conditions to a given required depth below the soil surface
  - Pits should be excavated to 3' below proposed bottom of non-infiltration BMPs and 11' below infiltration BMPs

Chapter 3: Site Soil and Infiltration Assessment

- Infiltration testing
  - Measures infiltration rate below BMP
  - Should occur at the proposed bottom of the BMP of each test pit
  - If fill is present within 11' of bottom of BMP, a second test should be conducted at the interface
  - Measured infiltration rates should be between 0.5 and 2.4 in/hr (add a design safety factor of 0.25-0.5)
- Infiltration testing types
  - Falling-head infiltration testing (in-situ)
  - Lab soil tests for proposed fill beneath BMP (ex-situ)

Storm Water Runoff BMP Sizing Requirements

- Three sizing requirements (Section 6.2 and Appendix C)
  - Peak runoff discharge rate requirement
  - Volume reduction requirement
  - Water quality treatment requirement
- Peak Runoff Discharge Rate Requirement
  - Only for Tier 3 projects requiring Planning Commission Review
  - Post-development peak storm water runoff discharge rate ≤ pre-development rate, up to a 25-yr, 24-hr storm event
  - Pre-development is defined as the existing land use condition prior to the proposed development activity

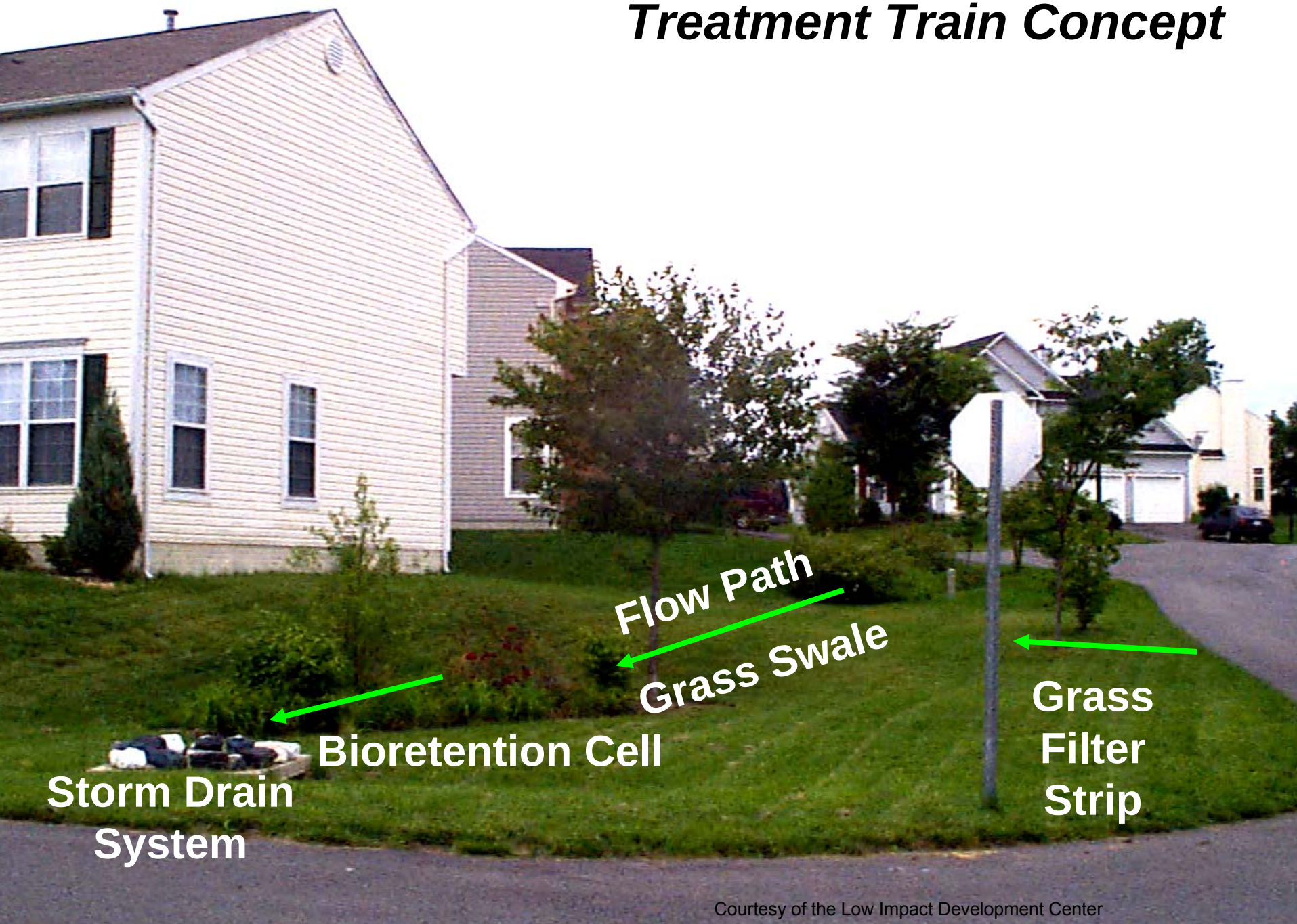
Storm Water Runoff BMP Sizing Requirements (cont'd)

- Volume Reduction Requirements
  - Only for Tier 3 projects requiring Planning Commission review
  - Retain on-site the larger of the following two volumes:
    - Volume difference between pre- and post-development conditions for the 25-yr, 24-hr design storm.
    - Volume generated from a one-inch, 24-hr storm event.
- Water Quality Treatment Requirements
  - For all Tier 2 or Tier 3 discretionary projects
  - Volume-based BMPs must be sized for 1-inch, 24-hr design storm
  - Flow-based BMPs must be sized for a rainfall intensity = 0.25 in/hr for a minimum of 4 hours

Strategies for Meeting the Requirements

- Volume reduction and water quality treatment requirements are not additive
  - Can be met simultaneously in many cases when using BMPs that allow for infiltration
- Reduce requirements by also using:
  - Site design BMPs (Chapter 4)
  - Basic BMPs (Chapter 5)
- Utilize treatment trains
- Add a gravel storage layer to increase infiltration

Treatment Train Concept

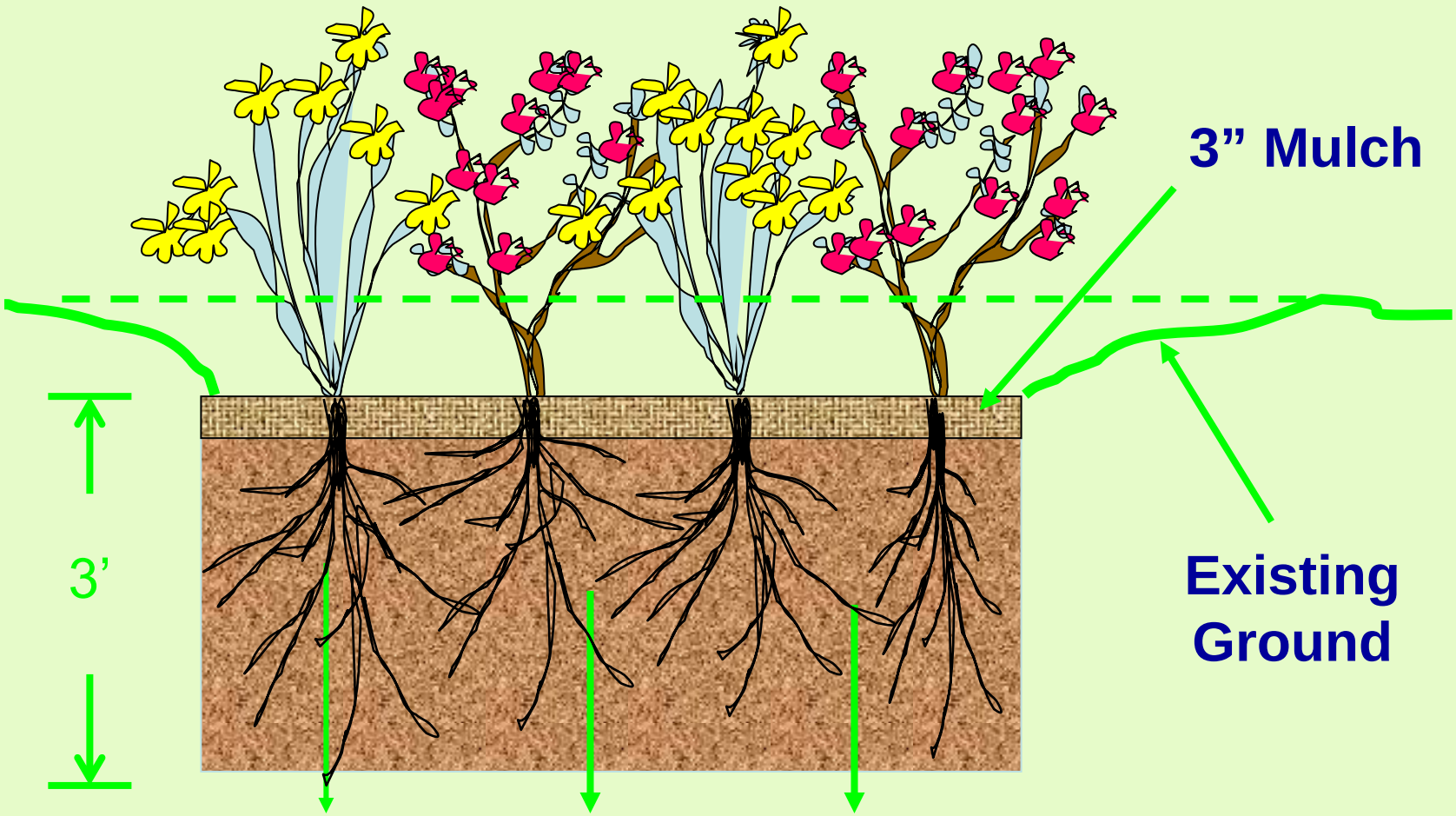


Courtesy of the Low Impact Development Center

Section 6.6.1: Bioretention

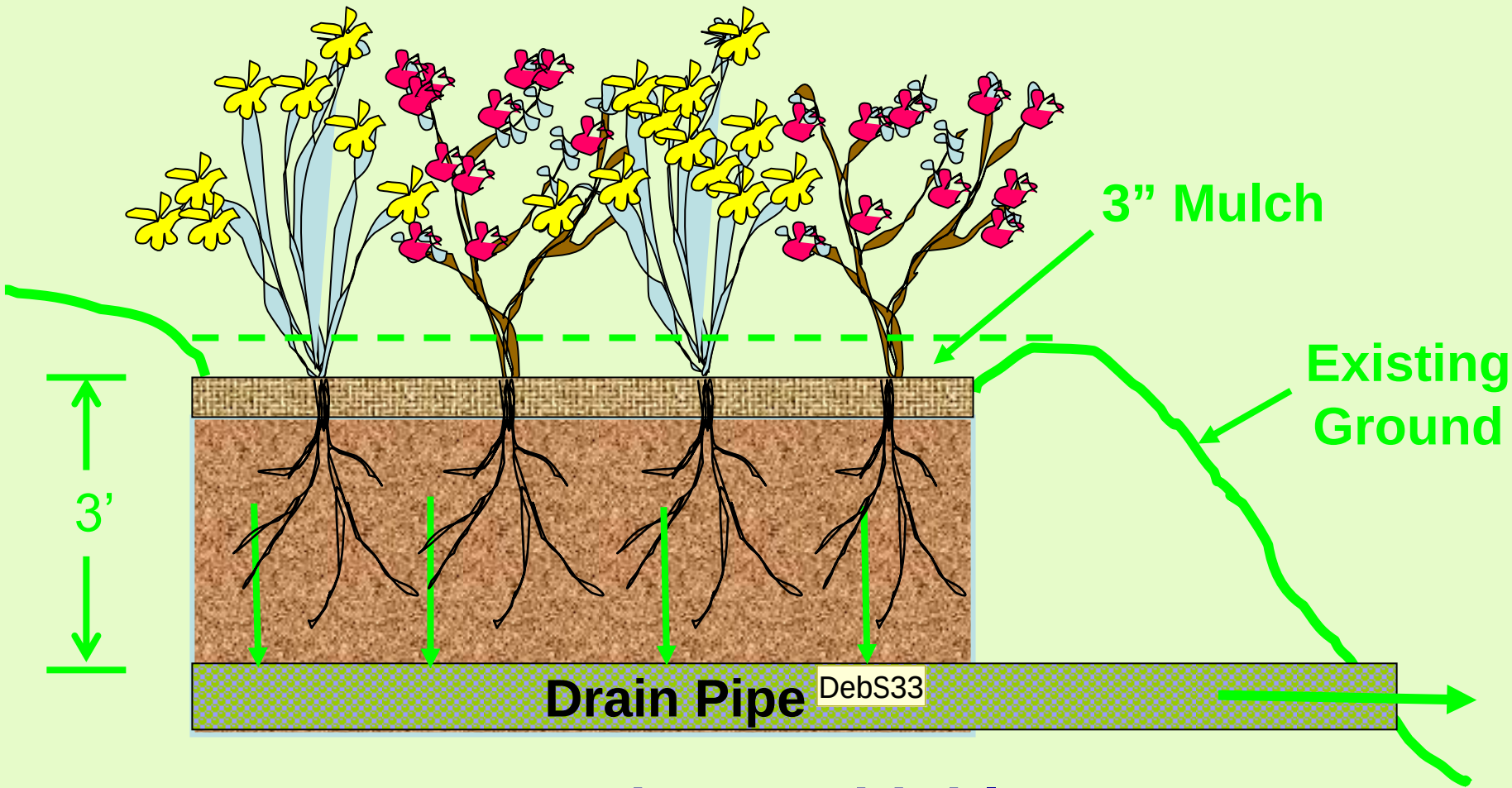
- Description
  - Landscaped shallow depression that captures, temporarily stores, filters, and infiltrates storm water runoff
- Applications
  - Commercial, mixed use, institutional, residential
  - Parking lots, cul-de-sacs, traffic circles
  - Road shoulders & medians
- Treatment Effectiveness & Site Suitability
  - Tables 6-1 and 6-2

Infiltration Bioretention System



Highly Pervious Soils

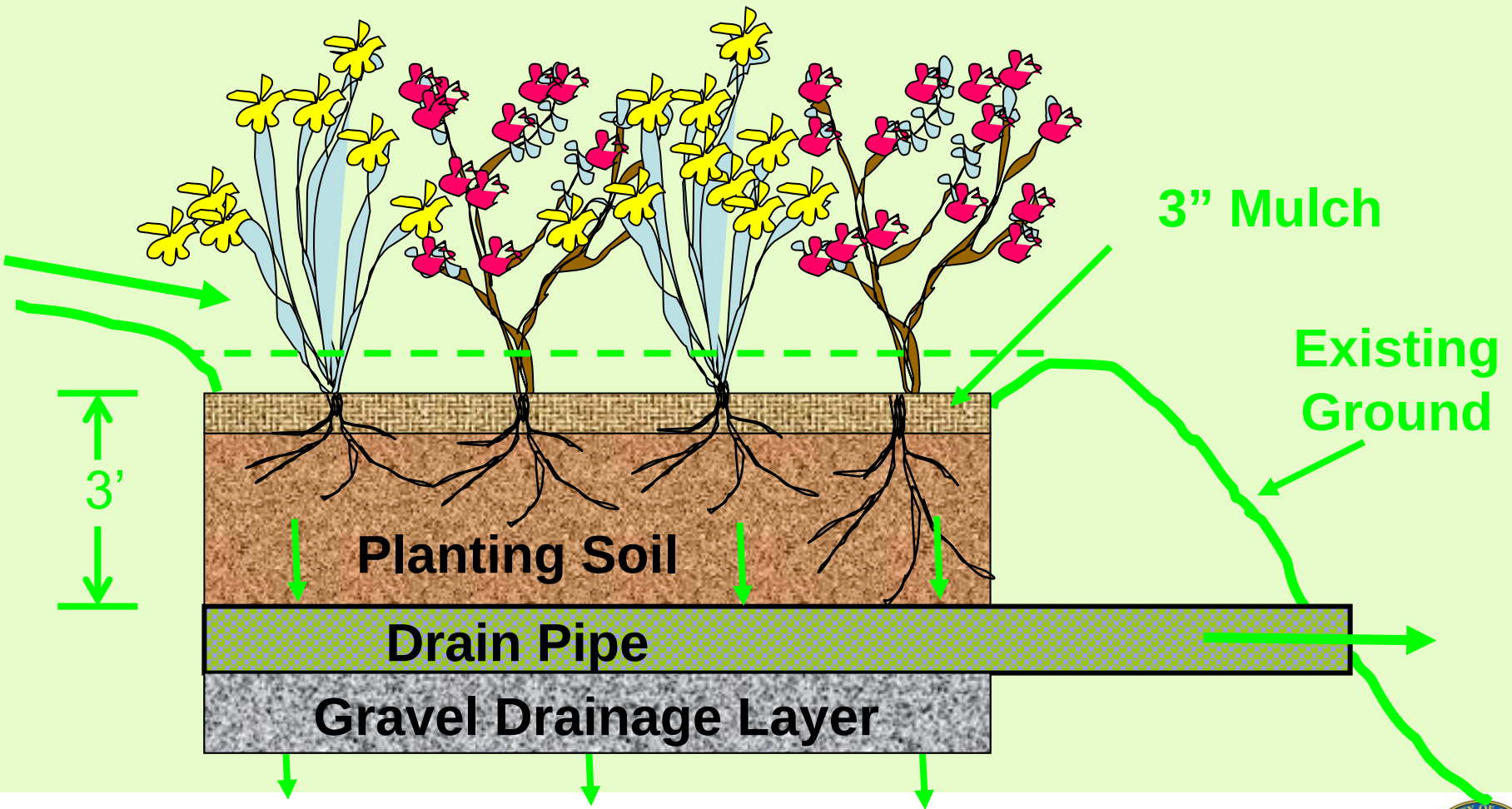
Filtration Bioretention System



Impervious or highly pervious soils

DebS33 Where does this pipe lead. Explain this.
Deb Stewart, 6/8/2009

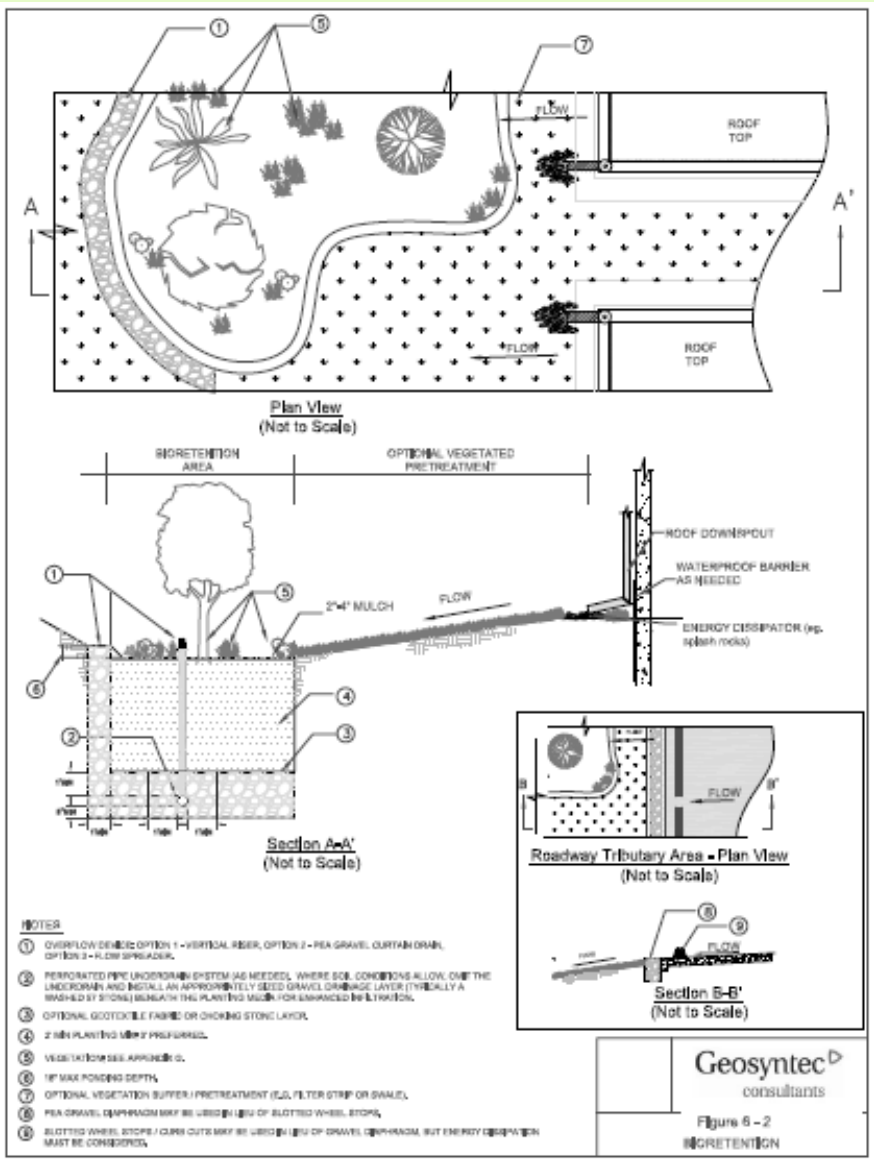
Combo Filtration/Infiltration Bioretention System



Moderately Pervious Soils

Section 6.6.1: Bioretention

Figure 6-2



Section 6.6.1: Bioretention

- Sizing Methodology
  - Determine the design infiltration rate
    - Infiltration rate testing (Chapter 3)
    - Apply a safety factor
  - Sizing calculations – determine surface area
    - Simple sizing method
    - Routing method – continuous simulation model
- Plant Selection
  - Must tolerate drought and periods of inundation up to 48 hours (w/o gravel drainage layer) or 72 hours (w/ gravel drainage layer)

Section 6.6.1: Bioretention

- Operations & Maintenance
  - General Requirements
    - Pruning/plant removal
    - Watering (up to 5 years)
    - Address erosion problems
    - Mulch replacement
    - Planting soil replacement
  - Maintenance Quick Guide
    - Table 6-7
  - Routine Maintenance Reqt's
    - Table 6-8

Common Causes of BMP Failure

Inadequate soil infiltration rate

Clogging due to unstabilized site

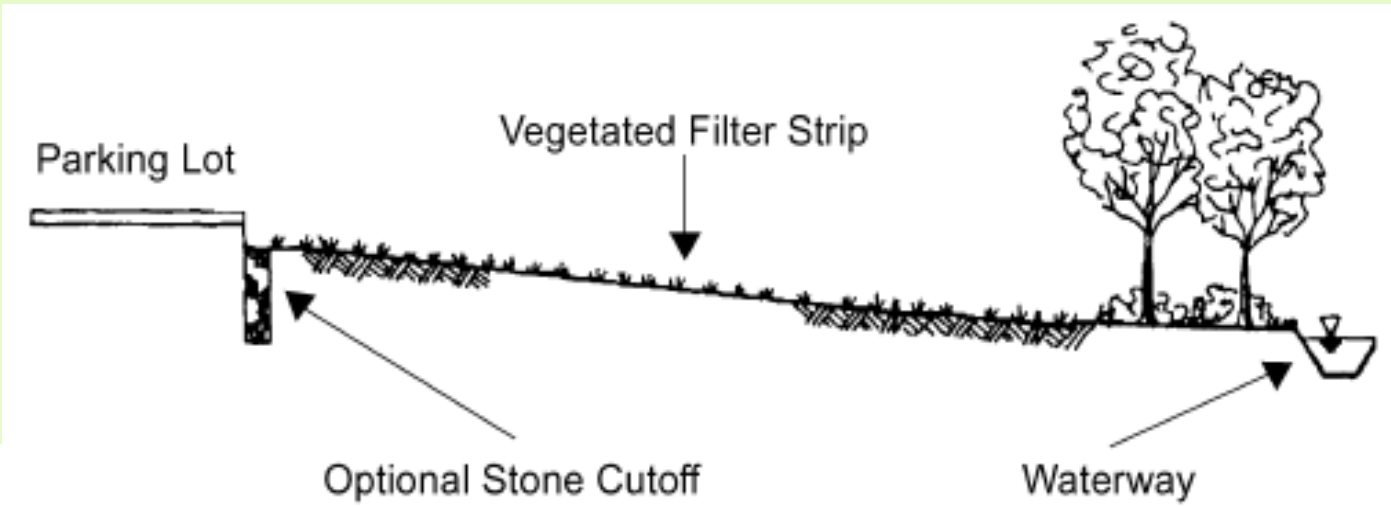
Lack of maintenance

Section 6.6.2: Vegetated Swales

- Description
  - Open shallow channels with low-lying vegetation covering the side slopes and bottom
- Applications
  - Commercial, mixed use, institutional, residential, multi-family
  - Parking lots, cul-de-sacs, traffic circles, road shoulders & medians
  - Open space, parks, golf courses

Section 6.6.3: Vegetated Filter Strip

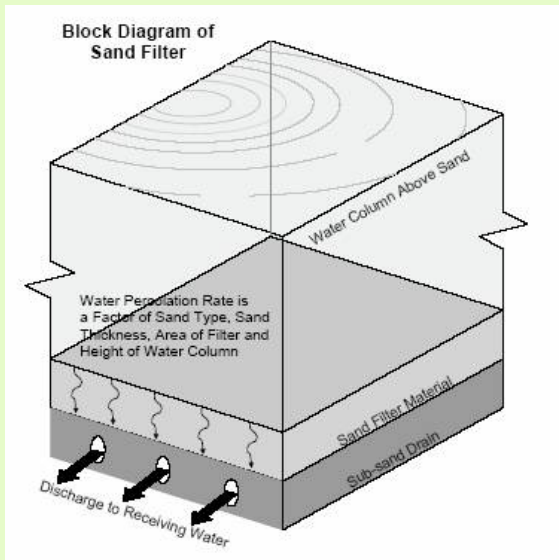
- Description
  - Vegetated area that filters sheet flow runoff from adjacent impervious surfaces
- Applications
  - Roads and highway shoulders
  - Small parking lots
  - Residential, commercial, or institutional landscaping



Section 6.6.4: Sand Filter

- Description
  - Contained sand bed filter with an underdrain system
  - Pretreatment is required

- Applications
  - Roads, highways, parking lots
  - Commercial and industrial
  - Roof runoff
  - Golf courses and open spaces



Section 6.7: Infiltration BMPs

- Description
  - Infiltration Basins
    - Shallow flat depression with vegetated bottom and sides
  - Infiltration Trenches
    - Long, narrow trench filled with aggregate or prefab material
  - Drywells
    - Excavated pit filled with aggregate or prefab material
- Applications
  - Commercial, residential, institutional
  - Roads, parking lots, parks, open spaces

Section 6.9.1: Cistern/Rain Barrel

- Description
  - Large rain barrels with capacity > 100 gallons
  - Collect and temporarily store runoff from rooftops for later use as irrigation or non-potable uses
- Applications
  - Any type of land use, provided adequate end use of water

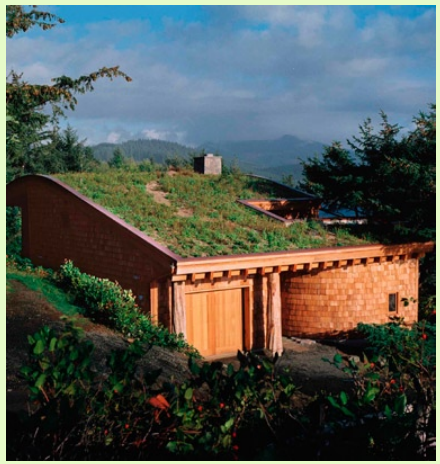
Section 6.9.2: Planter Boxes

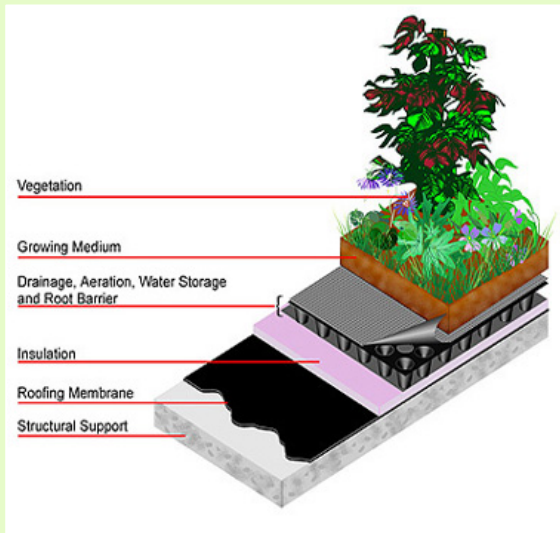
- Description
  - Boxes filled with gravel on bottom (for underdrain), planting soil media, and vegetation
  - Placed adjacent to buildings to capture roof runoff

- Applications
  - Commercial, residential, institutional
  - Mostly commonly used in urban areas adjacent to buildings and sidewalks

Section 6.9.3: Green Roofs

- Description
  - Roofing systems that layer a soil/vegetative cover over waterproofing membrane
- Types
  - Extensive – light weight system
  - Intensive – heaver weight system that allows for larger plants
- Applications
  - Commercial, residential, institutional
  - Parking decks





Section 6.10.1: Constructed Treatment Wetlands

- Description
  - Wetland with varying depths with aquatic vegetation covering a significant portion of the basin
  - Includes one or more permanent micro-pools (3 to 5 feet deep)
  - Sediment forebay settles out coarse solids
  - Basin outlet structure sizing – Appendix E
- Applications
  - Regional detention & treatment
  - Large footprint needed

Section 6.10.2: Wet Retention Basins

- Description
  - Constructed, naturalistic ponds with a permanent or seasonal pool of water
  - Require base flow to maintain permanent pool
  - Can be designed to provide extended detention
  - Sediment forebay settles out coarse solids
  - Basin outlet structure sizing – Appendix E
- Applications
  - Regional detention and treatment

Section 6.10.3:
Dry Extended Detention Basins

- Description
  - Basins whose outlets have been designed to temporarily detain storm water
  - Can promote infiltration by adding a sand filter beneath the basin
  - Sediment forebay settles out coarse solids
  - Basin outlet structure sizing – Appendix E
- Applications
  - Regional detention and treatment

Conclusions

- City SWMP is a City document NOT just a Creeks Division document
  - Department wide responsibility
- Water quality challenges have developed on an incremental basis
  - Need incremental solutions

Questions?